

09/865,597

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| 13       | 0      | ((707/\$ 345/\$).ccls.) and (determining same relationship\$1 same object\$1) and ((geometry adj1 approximation\$1) tile\$1) and ((quadtree linear spatial hybrid) near3 index\$3) and tessellation and (boundary intersect\$8) and ((primary secondary) adj1 filter\$1)     | USPAT | 2004/04/22 12:48 |
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| 17       | 6      | ((707/104.1 345/423).ccls.) and ((geometry adj1 approximation\$1) tile\$1) and ((quadtree linear spatial hybrid) near3 index\$3)   | USPAT | 2004/04/22 12:58 |
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| 20       | 1      | (determining same relationship\$1 same object\$1) same tile\$1   | USPAT | 2004/04/22 12:59 |

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## Quadtrees for embedded surface visualization: construction and efficient data structures

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### Abstract:

The **quadtree** data structure is widely used in digital image processing and computer graphics for modeling spatial segmentation of images and surfaces. A **quadtree** in which each node has four descendants. Since most algorithms based on **quadtree** require complex navigation between nodes, efficient traversal methods as well as efficient storage techniques are of great interest. In this paper we first propose an efficient **indexing** scheme for a linear (pointerless) **quadtree** data structure. The **quadtree** is stored using a unidimensional array of nodes. Our **indexing** scheme has the property that the navigation between any pair of nodes can be computed in  $O(\log n)$  time. Moreover the navigation across multiple **quadtrees** can be achieved at no extra cost. We illustrate our results on applications in computer graphics. We first solve the problem of computing a so-called restricted **quadtree** can be solved at  $O(n \log n)$  e.g. with a computational complexity having the order of magnitude of the problem. Then, we explain how this problem can be solved in the case of surfaces modeled by multiple **quadtrees**. Finally, we show how a **tessellated** sphere can be implemented and navigated using our data structure.

### Index Terms:

[image segmentation](#) [quadtrees](#) [computational complexity](#) [computer graphics](#) [digital image processing](#) [embedded surface visualization](#) [indexing scheme](#) [quadtree](#) [quadtree structure](#) [spatial segmentation](#) [tessellated sphere](#)

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